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SYNONYMS

St. Barnaby's thistle, golden thistle, cotton-tip thistle

CLASSIFICATION

RANKING	SCIENTIFIC NAME	COMMON NAME
Kingdom	Plantae	Plants
Subkingdom	Tracheobionta	Vascular plants
Superdivision	Spermatophyta	Seed plants
Division	Magnoliophyta	Flowering plants
Class	Magnoliopsida	Dicotyledons
Subclass	Asteridae	
Order	Asterales	
Family	Asteraceae	Sunflower family
Genus	<i>Centaurea</i>	
Species	<i>Centaurea solstitialis</i> L.	Yellow starthistle

HISTORY AND DISTRIBUTION

Yellow starthistle is native to Europe, Western Asia, and the Mediterranean. Its seeds were found in adobe bricks in California beginning in the early 1800s. Since the mid-1800s, it was also likely introduced to North America in contaminated seed of alfalfa and other crops. Yellow

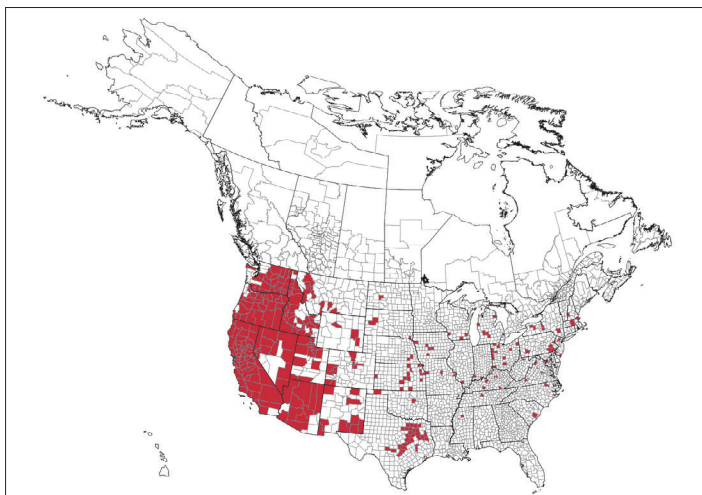


Figure 1. Yellow starthistle reported distribution in North America (Credit: EDDMapS, www.eddmaps.org; accessed 4 April 2023)

starthistle has been recorded in 39 states in the USA (Fig. 1), though it is most problematic in the West. While a few plants were previously found in Alberta, British Columbia, Ontario, and Saskatchewan, no populations have persisted in Canada to date.

IMPACT

Yellow starthistle is one of the most problematic introduced plant species currently threatening conservation areas and rangeland in the western USA. It reduces biodiversity by displacing native vegetation in grasslands and woodlands. The thorny spines that surround starthistle flower heads interfere with grazing by livestock and wildlife as well as recreation. It is toxic to horses, causing a chronic and potentially fatal neurological disorder known as “chewing disease”. Because of its excessive water usage, yellow starthistle threatens both human economic interests and native plant ecosystems.

IDENTIFICATION

AT A GLANCE

Yellow starthistle is an herbaceous winter annual typically growing 1–3 ft (30–90 cm) tall from a deep taproot. Rosettes have deeply lobed leaves up to 6 in (15 cm) long. Plants produce one or more rigid, upright stems with multiple spreading and ascending branches (Fig. 2). Stem leaves are typically narrow, unlobed, and attach directly to plant stems by wings that run down the sides of the stems. All stems, leaves, and wings are covered in densely matted hairs, resulting in a characteristic gray-green color. Flower heads are produced at tips of branches, and sometimes at leaf or branch axils. Flower heads are up to ¾ in (2 cm) across and consist of 10–80 bright yellow florets. The bracts are spiny and up to 1 in



Figure 2. Yellow starthistle plant (Patrick Wagner, iNaturalist.org CC BY-4.0)



Figure 3. Yellow starthistle (a) grows from a deep taproot. Plants are typically 1–3 ft tall but may grow to 6 ft or (b) 6 inches. Stems (c) are winged. Rosette leaves are lobed and grow (d) close to the ground at open sites but (e) more upright at crowded sites. Stem leaves (f) become less lobed and smaller up the stem. Flower heads (g) have 10–80 yellow florets and numerous spiny bracts. Bracts (h) are hairy at their base; each has a long central spine and two or more pairs of side spines. Two types of seeds are produced (i); plumed seeds (left) have a ring of bristly pappus while plumeless seeds (right) do not. (a–i: Travis McMahon, MIA Consulting)

(2½ cm) long. Seeds are oblong and up to ⅛ in (3 mm) long. Plumed seeds are tan to brown, located at the center of the seed head, and have a ring of pappus consisting of fine, white bristles. Plumeless seeds are dark brown to black, fewer in number, occur around the periphery of the seed head, and lack pappus.

Roots

Yellow starthistle develops taproots that are slender and deep (Fig. 3a), growing more than 3½ feet (1 m) long. Taproots have fine, thread-like extensions.

STEMS AND LEAVES

Plant height varies depending on site conditions. While most rangeland plants are 1–3 ft (30–90 cm) tall, individuals

growing in wet locations can reach up to 6 ft (1.8 m) tall, and those growing in hot, dry areas can be as short as 6 in (15 cm; Fig. 3b). Plants have one or more flowering stems with multiple spreading and ascending branches (Fig. 2). Stems are upright, rigid, and winged (Fig. 3c). Rosettes consist of numerous leaves. At open sites these lie close to the ground (Fig. 3d); where numerous yellow starthistle plants are crowded together, rosette leaves grow more upright (Fig. 3e). Each basal leaf is 2–6 in (5–15 cm) long with lobed margins. The lobes are irregular, they may be opposite or alternate from each other, and the terminal lobe is larger than the side lobes (Fig. 3d). Stem leaves are alternate and attach directly to plant stems by wings that run down the sides of the stems (Fig. 3f). Stem leaves may be lobed (Fig. 3c) but are more often narrow with smooth margins (Fig. 3f). Stem leaves are typically smaller

than rosette leaves; they may be 0.4–4 in (1–10 cm) long. All stems, leaves, and wings are densely covered with matted hairs, giving the plant its characteristic gray-green color.

FLOWERS

Flower heads are solitary and produced at the tips of branches (**Fig. 2**), though vigorous plants may also produce flower heads at leaf and branch axils. Each flower head is up to $\frac{3}{4}$ in (2 cm) across and has 10–80 disc florets (**Fig. 3g**). Each floret consists of five bright yellow, fused petals. Bracts occur in shingle-like layers around the base of the flower head. Bracts are densely to sparsely covered with hairs (**Fig. 3h**), and each bract has one long central spine up to 1 in ($2\frac{1}{2}$ cm) long and two or more pairs of short side spines (**Fig. 3g,h**).

FRUITS AND SEEDS

Each floret produces a single seed up to $\frac{1}{8}$ in (3 mm) long. Two types of seeds are produced: plumed and plumeless at an average ratio of 3:1. Plumed seeds are cream to brown, located at the center of the seed head, and have a ring of pappus consisting of fine, white bristles (**Fig. 3i, left**). Plumeless seeds are dark brown to black, fewer in number, occur around the periphery of the seed head, and lack pappus (**Fig. 3i, right**). Seed production varies greatly depending on soil moisture, nutrients, and plant competition. A mature plant produces 1–200 flower heads and 1,000–6,000 seeds.

ECOLOGY

Yellow starthistle spreads only by seeds. In Mediterranean climates with hot dry summers and moist winters, germination occurs in the fall after autumn rains begin. Spring germination occurs elsewhere in North America. Rosettes develop from fall through spring, quickly developing long taproots. Stems bolt in late spring, and flowering occurs throughout summer. Very small plants may have an unbranched stem and one flower head (**Fig. 3b**) while larger plants can have over 100 flower-tipped branches. Some seeds may remain viable for up to 10 years, though most germinate within three. The majority of seeds fall within $3\frac{1}{3}$ feet (1 m) of the parent plant. Short to medium dispersal of plumed seeds is facilitated by animals and humans; the seed pappus readily tangles in fur, feathers, and clothing. Long distance dispersal typically occurs with the movement of seed-contaminated livestock, vehicles, equipment, hay, and crop seed. Plants typically die after setting seed.

HABITAT

Yellow starthistle capitalizes on soil disturbance, but it can spread into undisturbed sites as well. It is a serious weed of roadsides, rangeland, pastures, shrub steppe, abandoned cropland, and disturbed places (**Fig. 4a–c**). Yellow starthistle



Figure 4. Yellow starthistle growing (a) along a roadside, (b) on an overgrazed hillside, (c) in a pasture (a,b: Travis McMahon, MIA Consulting; c: Steve Dewey, Utah State University, Bugwood.org CC BY 3.0 US)

occurs in a variety of soils and conditions but is most common below 4,000 ft (1,200 m) in elevation on south-facing slopes in areas with more than 6 in (15 cm) of rain annually.

SIMILAR SPECIES

While numerous species in North America have similar lobed leaves and yellow flower heads, they are easily differentiated by lacking the gray-green coloration as well as the spiny bracts on their flower heads. Several weedy species in the same genus (*Centaurea*) more closely resemble yellow starthistle in earlier stages by having similar gray-green, hairy, and lobed leaves or winged stems. These can often be differentiated by lacking sharp spines on the bracts or having different floret colors. The introduced Malta (*C. melitensis*) and Sicilian starthistle (*C. sulphurea*) are perhaps the most similar in that they have spiny flower heads with yellow florets. Malta starthistle is

often smaller, has purplish coloring at the base of its bracts, and all of its seeds have fine pappus. Sicilian starthistle has unlobed leaves, its flower heads are larger, and its seeds all have

dark brown pappus. Species most closely resembling yellow starthistle are listed in **Table 1**, along with key characteristics that can be used for differentiation.

Table 1. Key traits for differentiating yellow starthistle from similar related species established in North America.



















SPECIES	SIMILARITIES	DIFFERENCES	PLANT	ROSETTE LEAF	FLOWER HEAD
Dandelion <i>Taraxacum officinale</i> Asteraceae Introduced biennial or perennial	Taproot; rosette leaves lobed; large yellow flower heads; florets yellow; seeds with pappus	Stems hollow, unbranched, leafless, fleshy, not winged; rosette leaves hairless; flower head bracts not spiny; no plumeless seeds; all parts of the plant exude a milky latex when damaged			
Prickly lettuce <i>Lactuca serriola</i> Asteraceae Introduced annual or biennial	Taproot; rosette leaves lobed; stem leaves alternate; flowering stem often branched; flower heads with yellow florets; seeds with pappus	Rosette leaf lobes jagged along margins; stems not winged; prickly hairs all along stems and undersides of leaf vein; flower heads much smaller; flower head bracts not spiny; no plumeless seeds; all parts of the plant exude a milky latex when damaged			
Rush skeletonweed <i>Chondrilla juncea</i> Asteraceae Introduced perennial	Taproot; rosette leaves lobed; stem leaves narrow, alternate; flower heads with yellow florets; seeds with pappus	Roots also sometimes creeping; stems not winged; stiff, downward-pointing hairs at stem base; flower heads much smaller; flower head bracts not spiny; no plumeless seeds; all parts of the plant exude a milky latex when damaged			
Purple & Iberian starthistle <i>Centaurea calcitrapa</i> & <i>C. iberica</i> Asteraceae Introduced annuals to short-lived perennials	Taproot; foliage gray-green, covered in small hairs; rosette leaves lobed; stem leaves alternate; similar height; flower heads with spiny bracts; all seeds have pappus (Iberian starthistle); all seeds without pappus (purple starthistle)	Leaves more deeply lobed; stems not winged; foliage hairs often resinous; florets purple			
Malta starthistle <i>Centaurea melitensis</i> Asteraceae Introduced annual or biennial	Taproot; foliage gray-green, covered in small hairs; stems winged; rosette leaves lobed; stem leaves alternate; florets yellow; flower heads with spiny bracts; seeds with pappus	Grows shorter under similar conditions; leaf lobes more rounded; flowers earlier in year; bracts smaller, purple-colored at their base; no plumeless seeds			
Sicilian starthistle <i>Centaurea sulphurea</i> Asteraceae Introduced annual	Taproot; foliage gray-green, covered in small hairs; stems winged; similar height; stem leaves alternate; florets yellow; flower heads with spiny bracts; seeds with pappus	Leaves not lobed; leaf margins more toothed; flower heads typically larger; no plumeless seeds; seeds twice as large; pappus dark			

Photo credits Table 1: dandelion plant (Philipp Weigell, Wikipedia.org CC BY-3.0), rosette leaves (Travis McMahon, MIA Consulting), flower head (Ara Lobato Ortigoza, iNaturalist.org CC BY-NC 4.0); prickly lettuce plant (Travis McMahon, MIA Consulting), leaf (Дарья Друщенко, iNaturalist.org CC BY 4.0), flower head (Eric Koberle, iNaturalist.org CC BY-NC 4.0); rush skeletonweed plant, rosette leaf (Travis McMahon, MIA Consulting), flower head (Rachel Winston, MIA Consulting); purple starthistle plant, rosette leaf, flower head (Travis McMahon, MIA Consulting); Maltese starthistle plant (Ashlyn B, iNaturalist.org CC BY-NC 4.0), rosette leaves (Eli Diego Moreno, iNaturalist.org CC BY-NC-SA 4.0), flower head (Richard Breisch, iNaturalist.org CC BY-NC 4.0); Sicilian starthistle plant, rosette leaf (Quentin Groom, iNaturalist.org CCO), flower head (Daniel Montesinos, Wikipedia.org CC-BY-SA 3.0)

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SUGGESTED CITATION

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